Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Electronics) (Fourth Semester)
(NEP) EXAMINATION, 2025-26
BIOMEDICAL ELECTRONICS (ELECTIVE)

Paper Code							
B	1	4	1	0	0	5	T

Questions Booklet Series
A

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

(Only for Rough Work)

1. Biomedical engineering primarily deals with :

   (A) Application of engineering principles to medicine and biology

   (B) Manufacturing of pharma-ceuticals

   (C) Hospital administration

   (D) Genetic modification only

2. The man-instrumentation system mainly studies :

   (A) Human interaction with measuring instruments

   (B) Chemical reactions in the body

   (C) Drug synthesis

   (D) Genetic engineering

3. Which component converts physiological variables into measurable electrical signals ?

   (A) Amplifier

   (B) Transducer

   (C) Oscillator

   (D) Filter

4. An active transducer is one that :

   (A) Requires external power for operation

   (B) Generates its own electrical output without external power

   (C) Operates only at low frequencies

   (D) Works only with digital systems

5. Strain gauge used for physiological measurements is an example of :

   (A) Passive transducer

   (B) Active transducer

   (C) Optical transducer

   (D) Digital sensor

6. The resting membrane potential of a typical nerve cell is approximately :

   (A) + 70 mV

   (B) – 70 mV

   (C) + 120 mV

   (D) – 120 mV

7. Action potential propagation in nerve fibers occurs due to :

   (A) Ion exchange across cell membrane

   (B) Electron flow through cytoplasm

   (C) Thermal conduction

   (D) Optical transmission

8. The bioelectric signal recorded from the heart is called :

(A) EEG

(B) EMG

(C) ECG

(D) EOG

9. EEG is primarily used to measure electrical activity of :

(A) Heart

(B) Brain

(C) Muscles

(D) Lungs

10. EMG measures electrical activity of :

(A) Muscles

(B) Brain

(C) Heart

(D) Liver

11. Evoked potentials are electrical signals produced in response to :

(A) Mechanical stimulus

(B) External sensory stimulus

(C) Thermal stimulus

(D) Chemical stimulus

12. A microelectrode is mainly used for :

(A) Surface measurements

(B) Intracellular potential measurements

(C) Blood pressure measurement

(D) Temperature measurement

13. Body surface electrodes are commonly used in :

(A) ECG recording

(B) DNA sequencing

(C) Blood analysis

(D) X-ray imaging

14. Needle electrodes are mainly used for recording :

(A) Brain activity

(B) Muscle activity

(C) Heart activity

(D) Skin resistance

15. The electrode-electrolyte interface produces :

(A) Polarization potential

(B) Magnetic flux

(C) Optical emission

(D) Mechanical vibration

16. The electrical activity of the heart is recorded using :

(A) EEG

(B) EMG

(C) ECG

(D) PCG

17. The frequency range of a typical ECG signal is approximately :

(A) 0.05-150 Hz

(B) 1-10 kHz

(C) 10-20 kHz

(D) 100-500 kHz

18. The main function of an ECG amplifier is to :

(A) Increase heart rate

(B) Amplify small cardiac electrical signals

(C) Generate ECG signals

(D) Measure blood pressure

19. Which electrode material is commonly used in ECG recording ?

(A) Copper

(B) Silver/Silver chloride

(C) Aluminium

(D) Gold

20. Standard limb leads used in ECG are :

(A) I, II, III

(B) V1, V2, V3

(C) aVR, aVL, aVF

(D) I, aVR, V6

21. The number of chest leads in a standard ECG is :

(A) 2

(B) 4

(C) 6

(D) 8

22. Vector cardiography records :

(A) Electrical vector magnitude and direction of heart activity

(B) Blood pressure variations

(C) Brain electrical signals

(D) Muscle contraction

23. Holter monitoring refers to :

(A) Short-term ECG recording

(B) Continuous 24-hour ECG recording

(C) Blood pressure monitoring

(D) EEG monitoring

24. Stress testing ECG is mainly used to detect :

(A) Lung disease

(B) Coronary artery disease

(C) Kidney failure

(D) Liver malfunction

25. The normal resting heart rate for adults is approximately :

(A) 20-40 bpm

(B) 60-100 bpm

(C) 120-160 bpm

(D) 200 bpm

26. Blood pressure is commonly measured using :

(A) Sphygmomanometer

(B) Spirometer

(C) Thermometer

(D) ECG

27. The Korotkoff sounds are associated with measurement of :

(A) Heart rate

(B) Blood pressure

(C) Blood flow

(D) Lung volume

28. Blood flow measurement using electromagnetic flowmeter is based on :

(A) Faraday's law of electromagnetic induction

(B) Ohm's law

(C) Kirchhoff's law

(D) Coulomb's law

29. Heart sounds are recorded using :

(A) Electrocardiograph

(B) Phonocardiograph

(C) Electroencephalograph

(D) Spirometer

30. The first heart sound (S1) is mainly caused by :

(A) Opening of semilunar valves

(B) Closure of AV valves

(C) Opening of AV valves

(D) Closure of pulmonary valves

31. The primary function of the respiratory system is to :

(A) Pump blood

(B) Exchange oxygen and carbon dioxide

(C) Produce hormones

(D) Digest food

32. The instrument used to measure lung volumes and capacities is :

(A) Spirometer

(B) Sphygmomanometer

(C) Electrocardiograph

(D) Thermistor

33. Spirometry is mainly used to evaluate :

(A) Cardiac output

(B) Pulmonary function

(C) Blood pressure

(D) Brain activity

34. The volume of air inhaled or exhaled during normal breathing is called :

(A) Vital capacity

(B) Residual volume

(C) Tidal volume

(D) Inspiratory reserve volume

35. Vital capacity of lungs is the sum of :

(A) Tidal volume + inspiratory reserve + expiratory reserve

(B) Residual volume + tidal volume

(C) Inspiratory reserve + residual volume

(D) Expiratory reserve + residual volume

36. Residual volume refers to :

(A) Air remaining in lungs after maximum expiration

(B) Air inhaled during normal breathing

(C) Air exhaled during forced expiration

(D) Air inhaled during forced inspiration

37. A pneumotachograph measures :

(A) Blood pressure

(B) Airflow rate in respiration

(C) Oxygen concentration

(D) Body temperature

38. Respiratory rate of a healthy adult is approximately :

(A) 5-10 breaths/min

(B) 12-20 breaths/min

(C) 30-40 breaths/min

(D) 50-60 breaths/min

39. Ventilators are primarily used to :

(A) Monitor blood pressure

(B) Assist or replace spontaneous breathing

(C) Measure lung volume

(D) Record ECG

40. A respirator differs from a ventilator mainly in :

(A) Size

(B) Method of breathing assistance

(C) Electrical supply

(D) Cost

41. Mechanical ventilators control :

(A) Only oxygen concentration

(B) Breathing rate and tidal volume

(C) Blood pressure

(D) Heart rhythm

42. Positive pressure ventilators work by :

(A) Creating negative pressure outside chest

(B) Forcing air into lungs

(C) Removing oxygen from lungs

(D) Compressing diaphragm

43. Negative pressure ventilators operate by :

(A) Expanding chest using negative pressure outside body

(B) Pumping air directly into lungs

(C) Increasing blood flow

(D) Measuring lung capacity

44. An inhalator is used to :

(A) Measure respiration

(B) Deliver medication directly into lungs

(C) Measure oxygen saturation

(D) Record lung sounds

45. Nebulizers convert liquid medication into :

(A) Solid particles

(B) Fine aerosol mist

(C) Electrical signals

(D) Heat energy

46. Ultrasonic diagnostic imaging is based on :

(A) Reflection of high frequency sound waves

(B) Absorption of infrared radiation

(C) Nuclear decay

(D) Magnetic induction

47. Typical frequency range used in medical ultrasound imaging is :

(A) 20 Hz – 20 kHz

(B) 1 – 20 MHz

(C) 1 – 10 kHz

(D) 100 – 500 Hz

48. The piezoelectric crystal in ultrasound transducers converts :

(A) Electrical energy into mechanical vibrations and vice versa

(B) Magnetic energy into sound

(C) Heat energy into electricity

(D) Optical signals into electrical signals

49. Echocardiography is used to study :

(A) Brain activity

(B) Heart structure and motion

(C) Lung capacity

(D) Kidney filtration

50. Echoencephalography is mainly used to examine :

(A) Brain structures

(B) Cardiac valves

(C) Lung tissues

(D) Bone density

51. Ophthalmic ultrasound scanning is used to diagnose :

(A) Eye disorders

(B) Liver disease

(C) Heart block

(D) Lung infection

52. A-mode ultrasound imaging represents :

(A) Amplitude *vs.* depth

(B) Brightness *vs.* time

(C) Color *vs.* frequency

(D) Phase *vs.* amplitude

53. B-mode ultrasound imaging provides :

(A) Two-dimensional cross-sectional images

(B) One dimensional signal

(C) Three dimensional images

(D) Frequency spectrum

54. Medical X-rays are produced when :

(A) High speed electrons strike a metal target

(B) Sound waves reflect from tissue

(C) Nuclear decay occurs

(D) Laser light interacts with atoms

55. X-ray imaging mainly depends on differences in :

(A) Tissue density and absorption

(B) Magnetic susceptibility

(C) Acoustic impedance

(D) Optical scattering

56. Which component controls the intensity of X-rays in an X-ray tube ?

(A) Cathode filament current

(B) Anode rotation

(C) Detector gain

(D) Grid voltage

57. Computed Tomography (CT or CAT scan) produces images using :

(A) Multiple X-ray projections reconstructed by computer

(B) Ultrasound echoes

(C) Magnetic resonance

(D) Infrared radiation

58. The main advantage of CT over conventional X-ray imaging is :

(A) Cross-sectional imaging

(B) Lower voltage requirement

(C) Use of sound waves

(D) Magnetic field usage

59. Emission Computed Tomography includes techniques such as :

(A) PET and SPECT

(B) ECG and EEG

(C) CT and MRI

(D) EMG and PCG

60. In nuclear medicine imaging, the patient is administered :

(A) Radioactive tracer

(B) Magnetic dye

(C) Ultrasound gel

(D) X-ray contrast only

61. The Ag/AgCl electrode is widely used because it has :

(A) High polarization

(B) Stable half-cell potential

(C) High temperature sensitivity

(D) Optical properties

62. A reference electrode is mainly used to :

(A) Provide stable potential reference

(B) Amplify signals

(C) Filter signals

(D) Generate pulses

63. pH electrodes are based on :

(A) Optical sensing

(B) Ion-selective glass membrane

(C) Magnetic sensing

(D) Thermal sensing

64. Blood gas electrodes are used to measure :

(A) Oxygen and carbon dioxide levels in blood

(B) Blood glucose

(C) Blood pressure

(D) Hemoglobin only

65. Major problem in measuring living systems is :

(A) Biological variability

(B) High voltage signals

(C) Lack of sensors

(D) Absence of noise

66. Biomedical transducers must primarily be :

(A) Large sized

(B) Biocompatible

(C) High power

(D) Heavy

67. Signal conditioning in biomedical instruments includes :

(A) Amplification and filtering

(B) Mechanical processing

(C) Chemical synthesis

(D) Genetic coding

68. Noise in biomedical signals mainly arises from :

(A) Power line interference

(B) Nuclear radiation

(C) Cosmic rays only

(D) Optical reflections

69. Which electrode type is used for intracellular recording ?

(A) Surface electrode

(B) Needle electrode

(C) Microelectrode

(D) Plate electrode

70. The amplitude of ECG signal recorded from body surface is approximately :

(A) 1 mV

(B) 1 V

(C) 10 V

(D) 100 V

71. An intensive care unit (ICU) monitoring system typically measures :

(A) ECG, respiration, blood pressure

(B) Only body temperature

(C) Only blood glucose

(D) Only brain signals

72. Patient monitoring displays are mainly used to :

(A) Store medical history

(B) Display real-time physiological signals

(C) Generate electrical signals

(D) Perform surgery

73. Calibration of patient monitoring equipment ensures :

(A) Correct and accurate measurements

(B) Faster operation

(C) Lower cost

(D) Reduced signal amplification

74. A pacemaker is primarily used to :

(A) Increase blood pressure

(B) Regulate abnormal heart rhythms

(C) Measure ECG

(D) Monitor respiration

75. An artificial pacemaker produces :

(A) Mechanical pulses

(B) Electrical impulses

(C) Magnetic waves

(D) Optical pulses

76. A defibrillator is used to :

(A) Record ECG signals

(B) Deliver high-energy shock to restore heart rhythm

(C) Measure blood flow

(D) Monitor respiration

77. The waveform displayed on ECG corresponding to ventricular depolarization is :

(A) P wave

(B) QRS complex

(C) T wave

(D) U wave

78. The T wave in ECG represents :

(A) Atrial depolarization

(B) Ventricular depolarization

(C) Ventricular repolarization

(D) Atrial repolarization

79. Non-invasive blood pressure measurement commonly uses :

(A) Oscillometric method

(B) Optical method

(C) Nuclear method

(D) Thermal method

80. A major requirement of ICU monitoring systems is :

(A) High noise level

(B) Continuous real-time monitoring

(C) Low sensitivity

(D) Manual recording only

81. Humidifiers are used in respiratory therapy to :

(A) Dry inhaled air

(B) Add moisture to inhaled gases

(C) Increase oxygen pressure

(D) Measure lung pressure

82. Dry medical gases may cause :

(A) Increased oxygen level

(B) Airway irritation and dryness

(C) Reduced breathing rate

(D) Increased blood pressure

83. Aspirators in hospitals are mainly used for :

(A) Removing mucus or fluids from airway

(B) Delivering oxygen

(C) Measuring lung volume.

(D) Monitoring heart rate

84. Respiratory therapy equipment must be :

(A) Non-sterile

(B) Biocompatible and sterile

(C) Magnetic

(D) Mechanical only

85. The diaphragm plays a major role in :

(A) Circulation

(B) Breathing mechanics

(C) Digestion

(D) Neural conduction

86. During inspiration, the diaphragm :

(A) Moves upward

(B) Moves downward

(C) Remains stationary

(D) Vibrates

87. During expiration, lung volume :

(A) Increases

(B) Decreases

(C) Remains constant

(D) Doubles

88. Peak expiratory flow rate measures :

(A) Maximum speed of expiration

(B) Oxygen concentration

(C) Heart output

(D) Blood flow

89. Respiratory monitoring in ICU often includes :

(A) ECG only

(B) Oxygen saturation and respiration rate

(C) Blood sugar

(D) Body temperature only

90. Pulse oximetry is used to measure :

(A) Blood glucose

(B) Oxygen saturation of blood

(C) Lung capacity

(D) Air pressure

91. Gamma cameras used in nuclear imaging detect :

(A) Gamma radiation from radioisotopes

(B) Infrared radiation

(C) Acoustic waves

(D) Magnetic flux

92. MRI Imaging is based on the principle of :

(A) Nuclear magnetic resonance

(B) Ultrasonic reflection

(C) Xnray absorption

(D) Optical fluorescence

93. The main magnetic field used in MRI scanners is typically :

(A) 0.1-3 tesla

(B) 1-10 gauss

(C) 100 tesla

(D) 1 millitesla

94. Hydrogen nuclei are mainly used in MRI because :

(A) They are abundant in body tissues

(B) They emit gamma rays

(C) They produce X-rays

(D) They absorb ultrasound

95. The RF coil in MRI is used to :

(A) Transmit and receive radiofrequency signals

(B) Generate X-rays

(C) Produce ultrasound

(D) Measure temperature

96. Which imaging technique does NOT use ionizing radiation ?

(A) MRI

(B) CT scan

(C) X-ray imaging

(D) Nuclear imaging

97. Contrast agents in CT imaging are mainly used to :

(A) Enhance visibility of tissues

(B) Reduce radiation

(C) Increase ultrasound speed

(D) Decrease scanning time

98. Resolution in ultrasound imaging depends mainly on :

(A) Frequency of ultrasound waves

(B) Blood pressure

(C) Magnetic field strength

(D) Tissue temperature

99. In PET imaging, annihilation of positrons produces :

(A) Two gamma photons

(B) Ultrasound waves

(C) Magnetic pulses

(D) Infrared light

100. MRI provides excellent imaging of :

(A) Soft tissues

(B) Bones only

(C) Teeth only

(D) Air cavities

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।